

NOTES ON TWO SLUGS OF THE GENUS VERONICELLA.

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Slugs of the genus *Veronicella* are numerous in the tropical regions of both hemispheres, 154 species having been described up to the present time. Dr. D. F. Heynemann^a has given a map of the world, showing the distribution of the known species. In this map Australia is shown to be without *Veronicella*, with the exception of a couple of species found at Brisbane; and these latter, according to Henry Tryon,^b have almost certainly been introduced. Nothing is known of *Veronicella* in New Guinea, where the related but very distinct genus *Prisma* takes its place. The group to which the names *Atopos*, *Prisma*, and *Padangia* have been applied extends from north Queensland through New Guinea to Amboina, Celebes, the southern Philippines, Sumatra, the Malay Peninsula, and Cochin China. Westward it occupies the same general regions as *Veronicella*, but eastward it seems to occur to the exclusion of it. Leaving the Austro-Malay region and passing on to the islands of the Pacific, we again meet with species of *Veronicella*, in New Caledonia, the Loyalty Islands, the New Hebrides, and even as far as the Fijis and Tahiti. The species of the Pacific Islands, noticeable for their rather small size, have been described from rather inadequate material, with the exception of *V. willeyi* Collinge^c from Lifu, Loyalty Islands. Further details have been especially desired in the hope of throwing some light on the origin of these animals. They are more or less arboreal, and the presumption would be that they were originally carried to the islands on floating trees; but the available ocean currents appear to set wholly from the American side, implying South American origin and a voyage of extraordinary length. It does not appear possible at the present time to demonstrate any close affinity with either the South American or Asiatic groups of *Veronicella*; but when we know more about the

^a Die Geographische Verbreitung der Nachtschnecken, 1905, pl. 2.

^b Queensland Agricultural Journal, July, 1899, p. 5.

^c Willey's Zoological Results, Pt. 4, 1899.

anatomy of the various neotropical and Malayan species this may be done. On the whole, in spite of the currents, it seems likely that the Pacific species are of Asiatic origin; and perhaps it may be assumed that in past times the currents of the Pacific Ocean were very different from what they are to-day. This is especially suggested by the fact that whereas the North Equatorial current, passing the Hawaiian Islands, comes from the American coast, the Hawaiian fauna shows every indication of having arrived from the opposite direction.^a

Pilsbry^b draws attention to the antiquity and comparative homogeneity of the mid-Pacific snail-fauna, and considers that the former (late palæozoic or early mesozoic) existence of a mid-Pacific continent is strongly indicated. This may be true, but it hardly seems possible to account for the *Veronicella* as remnants of the ancient fauna; and we are thus left to assume the agency of ocean currents, unless it can be believed that man carried these slugs about during his early migrations.

VERONICELLA AGASSIZI Cockerell.

This species was described^c from a specimen obtained by Dr. Alexander Agassiz in Tapaerui Valley, Tahiti. It was not possible to determine the anatomical characters, and nothing was known of the variation. Mr. R. W. Doane, of Stanford University, when recently in Tahiti, kindly collected a considerable series of specimens, which have made it possible to put the species on a much sounder basis. The original description of the external features remains valid; the specimens received are very uniform in appearance, the younger ones being paler than the adults. The dorsal surface is granular with small warts; its color coffee-brown, marbled with black, with no distinct dorsal band. Some of the younger specimens show slight indications of a dorsal band, consisting merely of a stripe on which the mottling is absent, and along the margins of which it tends to accumulate.^d The general form of the animal is shown in figs. 2 and 5. *V. gilsoni* Collinge,^e from the Fiji Islands, appears to be the nearest ally. So far as the external measurements go, there is no substantial difference. The color of *V. gilsoni* appears to be distinctive, and at present can not be matched in any of the Tahitian material. The

^a An ancient element of the Hawaiian flora, including several endemic genera of Composite, appears to be of American origin; while an apparently more recent group is Polynesian (Wallace, *Island Life*, 2d ed., pp. 325-6). The Tahitian Composite show Malayan affinities.

^b Proc. Acad. Nat. Sci. Phila., 1900, pp. 568-581.

^c Proc. U. S. Nat. Mus., XXIII, p. 835.

^d The same sort of thing, more exaggerated, is seen in the South American *Veronicella fusca* Heynemann.

^e Journ. of Malacology, VII, p. 179.

anatomy of *V. gilsoni* is unknown. The following table of Pacific *Veronicella* will assist in the separation of the species:

Dorsum with a very distinct light yellow band; female orifice close to sole; accessory glands 12 to 20.....	<i>V. willeyi</i> Collinge.
Dorsum without a band, or with at most traces of one, not lighter than the ground color	1.
1. Ground color dirty yellow, with small blackish blotches.....	<i>V. gilsoni</i> Collinge.
Ground color dark coffee brown.....	2.
2. Form very broad, the breadth about half the length (according to the figure)	<i>V. brunnea</i> Collinge.

(Evidently based on a juvenile.)

Form narrower, the breadth less than half the length; accessory glands 8
V. agassizi Cockerell.

Our largest *V. agassizi* is 36 mm. long and 14 mm. broad, the sole 3.5 mm. broad and the female orifice 3 mm. from sole and 23 mm. from anterior end. The average measurements were: Length, 25.6 mm.; breadth, 11.6; breadth of sole, 2.7; female orifice from sole, 2.1; female orifice from margin, 2.8, and from anterior end, 14.8. The female orifice is distant from the head 56.4 per cent of the total length.

The jaw is normal, strongly ribbed, as is sufficiently shown in fig. 1. The teeth are normal for the genus, with blunt dark points. The median tooth is small and narrow, the cusp not projecting beyond the basal plate. The first laterals are large and simple in form (fig. 4). The marginal teeth, as usual, are much smaller than the laterals.

The male generative organs are normal for the genus. The accessory glands are strikingly different from those of *V. willeyi*, being much shorter (little more than half the length of the dart-sac) and fewer in number (eight in the specimen examined). In *V. willeyi* they are not only numerous, but conspicuously longer than the dart-sac. The intestine is formed essentially as in *V. willeyi* and *V. brunnea*, but the stomach is covered by the liver. (See fig. 3.)

VERONICELLA SCHIVELYÆ BAHAMENSIS Dall.

This form was described by Doctor Dall^a from Nassau and Little Abaco, Bahamas. The typical *V. schivelyæ* Pilsbry comes from Bermuda and is exceedingly similar to the Mexican *V. moreleti* Crosse and Fischer. Upon comparing the descriptions of *V. moreleti* and *schivelyæ* (external characters), nothing distinctive was found, except that the female orifice was slightly more posterior in *schivelyæ*, and the dorsal bands were rather nearer to each other than either to the edge of the body. In the *bahamensis* form the bands are more or less evanescent in the adult though well-marked in the young. In all a strongly distinctive feature is the projection of the foot beyond the body posteriorly.

^a Smithsonian Misc. Coll., XLVII, p. 446.

As the anatomy of the *schirelyæ* forms was unknown, we were anxious to dissect specimens. Doctor Dall has very kindly sent us a specimen of *bahamensis* collected in the Bahamas by Mr. Riley. It is only half the size of the types, and unusually pale in color. Unfortunately, the generative organs were not developed, but fig. 8 represents the under surface, showing the projecting foot, and fig. 7 one of the alimentary canal and liver.

On the whole, it seems not unlikely that the Bahama and Bermuda slugs have been introduced from Mexico, and are in fact *V. moreleti*. This can not be demonstrated, however, until much more material is obtained, both of the Mexican and insular forms. The species of Florida, Cuba, and Jamaica, so far as known, are not of the *moreleti* type.

The measurements of the specimen of *V. schirelyæ bahamensis* examined by us are as follows: Length, 38 mm.; breadth, 16; breadth of sole, 5; female orifice from the sole, 2.5; from margin, 3.5; from anterior end, 21. The female orifice is distant from the head 55 per cent of the total length.

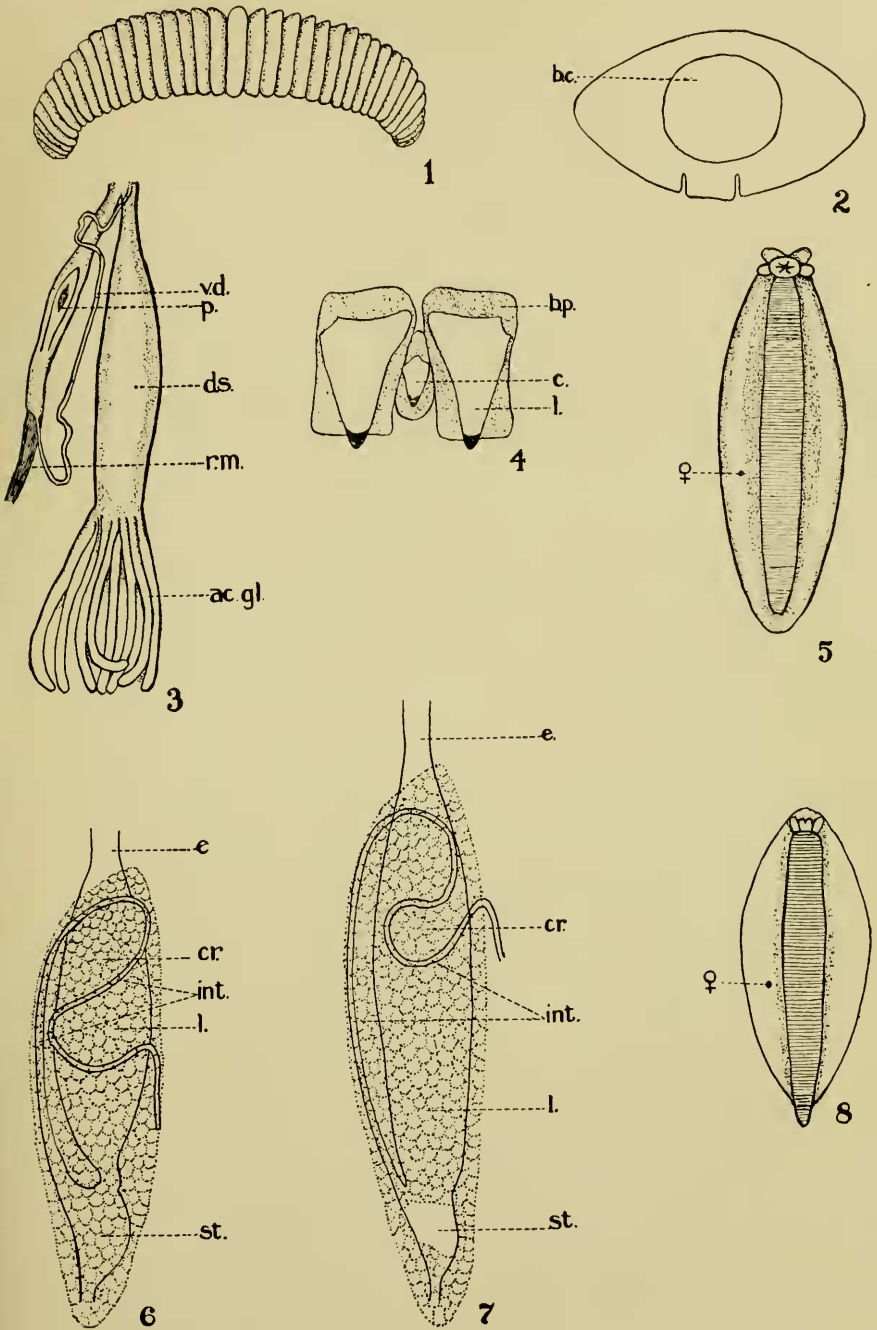
EXPLANATION OF PLATE 32.

Veronicella agassizi Cockerell.

- FIG. 1. Jaw.
 2. Diagrammatic transverse section through the body. *b. c.*, body cavity.
 3. Male generative organs. *ac. gl.*, accessory glands. *d. s.*, dart-sac. *p.*, penis. *r. m.*, retractor muscle. *r. d.*, vas deferens.
 4. Teeth. *b. p.*, basal plate. *c.*, central tooth. *l.*, lateral.
 5. View from ventral side. $\times 2$. Female generative orifice.
 6. Alimentary canal and liver. *cr.*, crop. *e.*, esophagus. *int.*, intestine. *l.*, liver. *st.*, stomach.

Veronicella schirelyæ bahamensis Dall.

7. Alimentary canal and liver. Lettering as in fig. 6.
 8. View from ventral side. Natural size. ♀ Female generative orifice.



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FOR EXPLANATION OF PLATE SEE PAGE 388.